

deplored more deeply the loss of its leader, F. M. Balfour. As an embryologist his fame will depend chiefly on the clear interpretation he gave to some of the descriptions of the German school, and to the application he made of these to human embryology. An adept with his pencil as with his pen, he gave expression to his views in diagrams that probably for many a day will help the bewildered reader. Thus, though his name will not be associated with any one great discovery, Dr. Thomson will be recognised as a potent force in biological science during this century. His own work, his judicious criticisms, his personal influence, his encouragement to workers, all had an important part in moulding the present state of scientific thought on biological questions.

As to the man himself, those who knew him can testify to the kindly courtesy, to the simplicity of address, to the indescribable charm of his manner, to the warmth of his friendship. He was wise in counsel and adroit in reconciling differences amongst men. To this he owed much of his social power. His finely-moulded and venerable face will be much missed, but not more so than his wise advice at the council board or to the young man who has chosen a scientific career. JOHN G. MCKENDRICK

QUINTINO SELLA

BY the death of Signor Quintino Sella, to which we briefly referred last week, Italian science loses one of her strongest supporters and most earnest students. Although some of the best years of his life were devoted to statesmanship, his early writings on mineralogy were of sufficient solidity to establish for their author a very high reputation. These mineralogical memoirs, contributed chiefly to the Royal Academy of Sciences of Turin, were distinguished by a profound knowledge of crystallography. When the Geological Survey of Italy was about to be established, Signor Sella was commissioned to visit most of the European countries where Surveys were in operation, and in 1861 he presented to Signor Cordova, then Minister of Agriculture, Industry, and Commerce, a valuable report, "*Sul Modo di fare la Carta Geologica del Regno d'Italia*." In collecting materials for that report he spent some time in this country, and took the warmest interest in the work of the Geological Survey. Ten years later he prepared an elaborate report on the mineral wealth of Sardinia. When the International Geological Congress was held at Bologna in 1881, Signor Sella, as one of the most representative scientific men in Italy, was selected to act as the president; and those who had the advantage of attending that meeting carried away with them the most pleasant recollections of his courtesy. Signor Sella died at Biella in Piedmont on the 14th inst.

We direct attention to the letter from Prof. Hughes in connection with a memorial to the Italian *savant*.

NOTES

At the final meeting, on Saturday last, of the General Committee of the International Fisheries Exhibition, the balance of the funds was disposed of. The surplus amounts to over 15,000*l.*, and of this 10,000*l.* were allotted to alleviate the distress of widows and orphans of sea fishermen, while 3000*l.* were voted as an endowment to a society which is to be called "*The Royal Fisheries Society*," whose functions will be somewhat similar to those of the Royal Agricultural Society; the remaining 2000*l.* are kept in reserve.

PROFESSORS MARTENS, Mendeléeff, and Minaieff are to attend the jubilee of Edinburgh University, as delegates from the University of St. Petersburg, and Prof. Rokhmaninoff as delegate from the University of Kieff.

THE great gold medal of the Paris Geographical Society has been awarded to the Deep-Sea Expeditions of the *Tulisman* and *Travailleur*; a gold medal to M. Arthur Thouar, for his journey across the desert of the Northern Chaco in search of the remains of the Crevaux Expedition; a gold medal to M. Désiré Charnay, for his Central American explorations, and especially his researches in Yucatan.

A MEETING of the Governors of the City and Guilds of London Institute for the Advancement of Technical Education was held last week for the purpose of receiving the Annual Report of the Council. The chair was occupied by the Lord Chancellor. The Chairman, in moving the adoption of the Report, said that the Institution had arrived at a critical point of time, at a point of time at which he might remind them of the progress which things had made, but one, nevertheless, at which it became necessary that they should recognise the importance of proceeding energetically. With respect to the Central Institution, the buildings were nearly completed, and it was expected that the public opening of those buildings might take place in June of this year. It was proposed that four professors should be appointed to the Central Institution—viz. Professors of Chemistry, of Engineering, of Mechanics and Mathematics, and of Physics, the whole being superintended by a Board of Studies. There would be laboratories properly fitted up, and workshops and drawing offices, all with a view to supplying instruction which would combine the elements of those fundamental studies which underlay practical art. It was hoped that, as time went on, the number of exhibitions and scholarships, which would enable poor and meritorious students to obtain the benefits of the Institution, might increase. It was estimated that 9000*l.* a year would be available for the maintenance of the Institution, and that the fees of the students would amount to 2000*l.* That would give 11,000*l.* as an expected present income. When the grant amounted to 10,000*l.*, and the students numbered from 150 to 200, paying in fees 5000*l.*, the income would be 15,000*l.*, and it was estimated that that amount would be required for maintaining the Institute in full working order. Passing from the Central Institution to Finsbury College, the Chairman said that the progress of that branch had been very satisfactory. During the past year it had instructed 799 persons, of whom 100 had been day students and the rest students attending the evening classes. The day students had to pass a preliminary examination in elementary mechanics, and there were six free scholars. The South London School had an attendance of 300 students. The candidates presented for examination this year were 2397, being an increase over the former year of 425, and the passes were 1498, showing an increase over the former year of 276. They came from 104 centres, showing an increase of seven centres; and they were examined, as in the former year, in thirty-seven subjects. What was still more remarkable was the rapid extension of the desire to have the benefit of these examinations, for there were now preparing for them 5862 students, being an increase over those who were under similar preparation in the former year of no less than 1814. He recognised with gratitude the liberality with which they had been supported by the City Guilds and other bodies, and he could not but think that those who had helped them so far would help them still further. Since the report had been written, the Skinners' Company had increased their subscription for the year 1884 from 500*l.* to 1000*l.*, and their donation to the building fund from 2000*l.* to 3000*l.*

A CORRESPONDENT sends us the following:—"The new scheme for examinations for admission to Sandhurst which has been agreed upon (it appears) by the War Office and the Civil Service Commissioners must, if unmodified, work serious mischief to scientific education in public schools in which any pro-

portion of the pupils are looking forward to the army as a profession. This will be seen from the following scale of marks, which has been communicated to the Committee of the Head Masters' Conference:—

	Marks
<i>Obligatory Subjects</i>	
(Three out of the four to be taken up by every candidate)	
Mathematics	3000
Latin	3000
French	3000
German	3000
<i>Optional Subjects</i>	
(One only to be taken up)	
Higher Mathematics	2000
Greek	2000
Chemistry	1500
Electricity and Magnetism	1500
Geology and Physical Geography	1500
English History	1500

A glance at this table is sufficient to show that the authorities are holding out a *distinct bribe* to candidates to eschew the experimental sciences altogether; and whatever their intention may be, the result will be the reduction of scientific knowledge among future officers of Her Majesty's army to the lowest possible minimum. This is surely a retrograde step in these late decades of the nineteenth century. Nor must it be forgotten that the application of the same scheme to examinations for admission to Woolwich is contemplated. Not only will every candidate be induced, if he can do so, to take up simply the four subjects in the first category, but, more than this, the scientific subjects (exclusive of mere mathematics) will only hereafter be taken up by those candidates whose performances in the more highly rewarded subjects are hopeless—the scientific subjects, in other words, will become simply a *refuge for mediocrity and incompetency*. Men who are spending the best years of their lives in combating the traditional prejudices which exist in this country in favour of the older studies will not only feel that they have to complain of the tardy and grudging recognition which is given to the 'new learning'—they will feel now, and justly so, that they have been betrayed by those from whom, on every ground, they ought to be able to look for more encouragement."

THE Worshipful Company of Clothworkers, who have already given 3500*l.* to the Bradford Technical School, have also promised an annual subscription of 500*l.* towards the working expenses of the school.

DR. DOBERCK writes from Hong Kong Observatory, February 17:—"The building of the Hong Kong Observatory was begun in June 1883, but only the foundations had been laid at the end of July, when I arrived. The main building, the architectural details of which do credit to the Surveyor-General's department, was so far finished by January 1 that I could take up my residence there, and tri-diurnal eye-observations were commenced. Before the middle of the month the magnetic hut was ready, and I lost no time in making a complete set of magnetic observations. I expect that it will be possible to start the self-recording apparatus by March 1. I get telegraphic weather information from the Treaty Ports, Nagasaki, Vladivostock, and Manilla, and publish weather reports, which, as you will see from one of the three newspapers which publish them (sent herewith) also indicate winds to be expected from the gradients."

THE Belgian Royal Academy proposes for public competition the subjoined subjects in the mathematical and physical sciences:—1. To resume and coordinate the researches hitherto made on the integration of linear equations of the second order with two variables, and to complete this theory, or at least advance it by further original research. 2. To establish by fresh experiments the theory of the reaction of bodies in the so-called nascent state. 3. Fresh spectroscopic researches with a view to ascertain especially whether the sun contains or not the essential constituent principles of organic compounds. 4. A complete exposition of the theory of deviations from the vertical, and verifying

whether it applies to existing observations. 5. Fresh researches on the nutritive deposits in cereals, and especially on the transformations experienced by them during germination. 6. Fresh researches on the development of the Trematodes, from the histogenetic and organogenetic standpoint. 7. A study of the influence of compressed oxygen on the vital phenomena. Medals of the intrinsic value of 32*l.* and 24*l.* are offered respectively for the best papers on the first three and last four subjects. The papers must be legibly written in French, Flemish, or Latin, and forwarded prepaid to M. Liagre, Permanent Secretary, Palais des Académies, Brussels. They are to be signed by a motto, which is to be repeated in a sealed note containing the authors' names and addresses.

IN the *American Journal of Science and Arts*, vol. xxiii. 2nd series, p. 276, a letter from Rev. George Jones, U.S.N., to Prof. Silliman, written at Quito, Ecuador, December 13, 1856, describes a fall of ashes from Cotopaxi, which was thirty miles distant, in which a purple sky was noted. The paragraph in which the mention is made runs as follows:—"Yesterday morning we noticed that at the south the sky had an unusual appearance, being of a purple colour for about 90° along the horizon, and so up to about 45° in height, the edge of this being mixed up with patches of white. About 12 o'clock ashes began to fall, first in small quantities; but by 8 o'clock the fall had got to be so considerable as to powder the clothes quickly, on our going out; and people coming into a house would look as we do at home when coming in from a snowstorm."

THE exploring expedition, under the direction of M. Regel, the naturalist, has again left for Bokhara on its way to Chardshui, Kelif Kabadian, and Baldshuat, whence it will proceed *via* the Pamir plateau as far as the Kashgar frontier. M. Schwartz, the astronomer, accompanies the expedition.

PROF. OSBORNE REYNOLDS will give a discourse at the Royal Institution to-morrow (Friday, March 28) on the Two Manners of Motion of Water shown by Experiments; and Prof. T. G. Bonney, the President of the Geological Society, will give a discourse on Friday (April 4) on the Building of the Alps.

ON Monday, at 9 p.m., a violent shock of earthquake, accompanied by a loud subterranean rumbling, was felt at Fünfkirchen, in Southern Hungary. It was also felt in Esseg and all over Slavonia. It is reported from Vienne that a shock of earthquake was felt there as well as at Karakul and in the Issyk-Kul district on the 13th inst.

AT one of the last meetings of the Russian Chemical Society, Prof. Mendeléeff made the following interesting communication with regard to solutions:—It would be easy to prove, with the data of Gerlach, Marignac, Cremers, and Schiff, that the volume of a given amount of a salt in its solutions (for instance, of a molecule) varies with the variations of temperature and the degree of concentration of the solutions. It increases as both increase; and it might be concluded therefrom that the force on which solution depends varies with the degree of concentration. Still, another conclusion can be arrived at, if Grassy's measurements of the decrease of volumes of NaCl and CaCl₂ be taken into account. Interpolation shows that these solutions are reduced in volume, by pressure, as the amount of the dissolved salt varies; and the reduction of volume which accompanies the solution enables us to calculate the corresponding pressure. It appears that to each molecule of NaCl dissolved in 100 parts of water corresponds a nearly permanent pressure of about 120 atmospheres, whatever be the degree of concentration. For CaCl₂ the pressure also remains constant, but is nearly three times the above. Thus, if the tendency towards solution be measured by pressure, it results, for the two salts above mentioned, that the first amounts of salt dissolved exercise the same pressure as

the last which bring the solution near to saturation. Prof. Mendeléeff points out that researches pursued in the direction just mentioned could throw some light on the internal forces which are active in solutions and other chemical compounds.

It appears from the annual report of the Russian Chemical and Physical Society that the chemical section has now 162 members; its income, including several grants, reached 5734 roubles (about 570*l.*), and its capital 13,932 roubles, of which 7894 roubles were devoted to premiums. The physical section has 103 members; its income reached 1851 roubles, and its capital 16,000 roubles.

At the annual general meeting of the Hackney Microscopical and Natural History Society held on March 19 at the Morley Hall, Hackney, a valuable microscope was presented to the honorary secretary by the members. The president, Dr. M. C. Cooke, in presenting the testimonial, made some highly eulogistic remarks upon the energy and unremitting attention given by the honorary secretary during the seven years of the existence of the Society, to which he ascribed its present flourishing condition. A silver plate bearing the following inscription was attached to the instrument:—"Presented to Collis Willmott, Esq., by members of the Hackney Microscopical and Natural History Society in appreciation of his services as Hon. Secretary, 19th March, 1884."

We have received from the Direction of Schools at Tiflis its annual report, and we are glad to recognise that education in the Caucasus—which is perhaps more independent of the Ministry of Public Instruction than other parts of Russia—is spreading more rapidly than might have been supposed. On January 1, 1883, there were no less than 1168 schools under the supervision of the Ministry, with an aggregate of 80,838 scholars, of whom 15,036 are girls. If the 60 Jewish and 1920 Mussulman schools at synagogues and mosques be added—how ever low the degree of education given to their 18,647 scholars—as also 31 schools of various descriptions, military, theological, and lower medical, the aggregate number of scholars would reach 102,728. There is thus (excepting the Jewish and Mussulman schools) one school for each 4880 inhabitants, surely still a very low figure; but it is a little higher in the more densely peopled Northern Caucasus (1 to 3060 in Kubau). Of the 1168 schools above mentioned there were 1055 primary schools, with 52,251 scholars, one-fifth of whom are girls; 33 higher primary schools, with 5213 scholars; 5 schools for teachers, with 500 scholars; 8 technical schools, or *Realschulen*, with 2312, and 10 lyceums, or half-lyceums, with 3555 scholars. We see with pleasure that there were also 6 lyceums and 6 half-lyceums for girls, with the high figure of 3127 scholars. The distribution of education among different nationalities is very interesting. Of the above-mentioned 80,838 scholars, 46 per cent. were Russians, 25 per cent. Armenians, 17 Georgians, and 5·2 Tartars and Circassians. With regard to the population, the proportion of Armenians receiving instruction is 1 to 41, while it is only 1 to 44 with the Russians, 1 to 75 with the Georgians, 1 to 350 with the Circassians, 1 to 851 with the Tartars, 1 to 33 with Jews, and 1 to 7 with the Western Europeans settled in the Caucasus. Even in lyceums the Armenians (1 to 858) come first after the Jews (1 to 210) and before the Russians (1 to 866), while only 1 to 11,237 Circassians, 1 to 9352 Tartars, and 1 to 1246 Georgians, enter the lyceums. The Russians like the technical schools better, and the daughters of the functionaries take the lead in the lyceums for girls. Altogether the tendency towards education is well felt in Northern Caucasus, and it is agreeable to see that in secondary schools—male and female—11 to 12 per cent of the scholars are children of peasants and Cossacks. The number of these schools is even too

small, and in 1882 no less than 441 boys were refused admission to lyceums on account of want of room. One may be sure that this tendency would be still greater were it not for the want of sympathy displayed throughout Russia with the so-called classical lyceums, where a mechanical study of Latin takes the place of sound instruction in natural sciences. We must notice also a beautiful educational map of the Caucasus which accompanies the Report for 1880. Owing to a system of coloured signs of different shapes, one sees at a glance the number of schools of different description, male and female, spread throughout the Caucasus, as well as who pays for them—the State, the municipalities, the village communes, or private persons; while a number of coloured plates on the borders of the map show the tendency towards instruction in different provinces, the nationalities of the scholars, and so on.

We are informed that Mr. Robert Hunt's (the Keeper of Mining Records) large and comprehensive work on the history, discovery, practical development, and future prospects of metalliferous mines in the United Kingdom, under the title of "British Mining," will be published early next month by Messrs. Croby Lockwood and Co.

AN IMPROVED THERMO-ELECTRIC PILE FOR MEASURING SMALL ELECTROMOTIVE FORCES¹

THIS paper contains a description, illustrated by sketches, of a new and convenient form of thermo-electric apparatus for measuring small electromotive forces by the method of opposition, and of the method of constructing and using the apparatus.

The apparatus consists essentially of a series of about 300 pairs of horizontal, slender, parallel wires of iron and German silver, the former alone being covered with cotton. The wires are about 8 inches long, fixed side by side in close mutual contact, though insulated from each other, as a continuous flat layer about 16 inches long, in a wooden frame, and soldered end to end in single continuous series. About 1½ inch in length of the opposite ends of the wires are bent downwards to a vertical position, so as to enable them to dip into two liquids of different temperatures contained in two long, narrow troughs. The liquids employed are non-conductors; this was found to be necessary. The one for the hot junctions is melted paraffin kept at a temperature of 120° C., and the one for the cold ones is non-volatile petroleum, known by the name of "thin machinery oil." The ends of the wires are immersed about one-fourth of an inch in the liquids.

The maximum power of the instrument is of course limited by the amount of difference of temperature of the two liquids, and of the two series of ends of wires immersed in them. Any lower degree of electromotive force is obtained by attaching a copper wire to one end of the series, and sliding the free end of the other terminal wire across the middle part of the upper surface of the wires, from that end of the series towards the other; the German silver wires being bare permit metallic contact.

An apparatus as above described, consisting of 295 pairs of wires, had a resistance of 95·6 ohms at 16° C., and by a difference of 100° C. of temperature of the two baths, gave a current having an electromotive force of 7·729 volt, or with a difference of 130° C., 1·005 volt. Each element therefore equalled 0·000262 volt for each C. degree difference of temperature.

After having been verified with a standard voltaic cell, such an apparatus (or any fraction of it) may itself be employed as a standard. It is capable of producing and measuring as small a degree of electromotive force as a 34861st part of a volt. When the potential of the currents to be measured exceeded one volt, either an additional pile or a standard voltaic cell was employed with it.

Several apparatus of this kind have been constructed, and a large number of determinations of electromotive force have been made with them. Fifteen determinations per hour have frequently been made; the rate of working, however, depends upon the steadiness of the current to be measured.

¹ Abstract of a paper read before the Birmingham Philosophical Society February 14, by Dr. G. Gore, F.R.S.